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Body Weight and Labour Market Outcomes in Post-Soviet Russia

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Abstract:

Purpose: The paper focuses on the impacts of overweight and obesity on the probability of employment, wages, and the incidence of sick-leave days by gender, in Russia, over the transition period, 1994-2005. **Approach**: We use panel data and appropriate instrumental variables techniques to estimate a set of three models. **Findings**: The results show a linear negative effect of BMI on probability of employment for women and positive effect for men. We did not find evidence of wage penalty for higher BMI, a result different from findings of several studies on developed market economies. There is also positive impact of BMI on the number of work days missed due to health problems for women. **Value**: Our results derived in transition context add evidence to the growing obesity and labour-market outcomes literature emphasising the relative importance of the labour supply side compared to the demand side. The policy implications of our study are gender specific.

JEL Classification: D12, J71, O52
Keywords: obesity, BMI, labour market outcomes, Russia

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1 Introduction

Globally, there are more than 1 billion overweight adults with at least 300 million considered obese. The increased consumption of more energy-dense foods and foods with high levels of sugar and saturated fats, combined with reduced physical activity, have led to obesity rates that have risen significantly since 1980 in developed (USA, the UK, Australia), transition (Eastern Europe) and emerging (the Middle East, China) economies (WHO, 2010). Thus, the prevalence of obesity has risen dramatically, not only in high income countries but in middle and low-income regions as well. Many studies have been published on the determinants and consequences of obesity in developed economies (Chou et al., 2004; Lakdawalla et al., 2005; Rashad et al., 2006). The trend of increasing obesity in transition economies has been analyzed for Russia (Zohoori et al., 1998; Jahns et al., 2003; Huffman and Rizov, 2007; 2010) and other Central and East European countries such as Lithuania and Poland (Kalediene and Petrauskiene, 2004; Koziel et al., 2004).

Obesity is a complex condition that has serious health, social, and psychological dimensions, affecting all ages and socioeconomic groups (WHO, 2010). The negative impacts of obesity on health are well known. Obesity is a major contributor to the global burden of chronic disease and disability, including diabetes, cardiovascular disease, and cancer. Economic burdens for countries with rising obesity are in the form of increased medical expenditures and individual economic insecurity. Obesity is linked to lower wages and employment, induced wage penalties, and job discrimination (Puhl and Brownell, 2001; Cawley, 2004). Given the health effects of obesity, obese individuals are more likely to have work limiting disabilities or to miss work due to illness if they are employed (Cawley et al., 2007). Obese workers may earn lower wages or have fewer chances to find employment due to employer discrimination (Puhl and Brownell, 2001). More studies have examined the relationship between obesity and wages (Averett and Korenman, 1996; Baum and Ford, 2004; Cawley, 2004; Morris, 2006; Gregory and Ruhm, 2009; Wada and Tekin, 2010), than the relationship between obesity and employment (Morris, 2007; Norton and Han, 2008).

The goal of this paper is to estimate the impacts of weight, measured by body mass index (BMI) on employment, wages, and missed work due to illness for Russian adults by gender, in an attempt to draw a complete picture of the relationship between obesity and labour market outcomes in transition context. The study extends the literature on the effects of weight on labour market outcomes by using panel data from the Russian Longitudinal Monitoring Survey (RLMS) for the period 1994-2005 - the transition from plan to market in Russia. In our empirical analysis we explicitly consider possible reverse causality from wages to obesity and the endogeneity of obesity. The paper is organized as follows. The next section discusses current evidence on the relationships between obesity and employment, wages and missed work due to illness. It is followed by sections reviewing the status of the Russian labour market and introducing our empirical methodology. Then, we present overview of the RLMS data and discuss estimation results. Finally, we draw conclusions.

2 Literature review

The relationships between high body weight (obesity) and labour market outcomes has been studied, primarily using data from developed, high income countries - the US and West Europe (England, Denmark, Finland, etc). The main labour market outcomes studied are wages/earnings, employment, and occupational selection. Earlier papers focused on the US have used the National Longitudinal Survey of Youth (NLSY) data, and find mixed results (Loh, 1993; Pagan and Davila, 1997). One limitation of the studies is that they ignore the potential endogeneity of obesity, making causal inference impossible.

Later studies have tried to control for the endogeneity of obesity using the Instrumental Variables (IV) approach. Cawley (2000b) uses the weight of a child as an instrument for the weight of the child's mother, and finds no evidence that body weight causes employment disadvantage. In another study, Cawley (2004) employs the fixed effect and IV models with the BMI of a sibling as instrument, and finds obesity wage penalty only for white females. Norton and Han (2008) identify the effect of obesity on labour market outcomes by using genetic information, and find no statistically significant effect of lagged BMI on either the probability of employment or wages conditional on employment, for either males or females. However, the instruments are sometimes weak and do not always pass the overidentification tests (Lindeboom et al., 2010).

Conley and Glauber (2007), using data from the Panel Study of Income Dynamics (PSID), estimate sibling fixed effects models where a body mass index measure is lagged by 15 years to correct for endogeneity bias. They found that obesity is associated with an 18% reduction in women's wages and a 16% reduction in women's probability of marriage. Gregory and Ruhm (2009) find little evidence of an "obesity penalty" but instead show that the wage is often maximized at low levels of BMI. Wada and Tekin (2010) develop measures of body composition, body fat, and fat-free mass, and analyze the relationship with wages. Their results indicate that body fat is associated with decreasing wages for both women and men, and fat free mass is associated with increased wages. In general, the literature on the relationship between BMI and wages finds that the BMI has significant negative consequences on earnings for women, and small or sometimes insignificant effects for men.

The effects of obesity on labour market outcomes have also been examined by European studies. Using data from the Health Survey for England, Morris (2006, 2007) assesses how BMI and obesity affect employment and earnings. He addresses the issue of endogeneity by employing the recursive bivariate Probit model and the propensity score matching method. As instruments, Morris uses area level variables, the mean BMI in the respondent's health authority, and the prevalence of obesity in the area in which the respondent lives. Results show that obesity (BMI) has a negative effect on employment for both genders, and that BMI has a positive and significant effect on earnings for men, but a significantly negative effect on women's earnings. Another study by Lindeboom et al. (2010) employs British data from the National Child Development Study (NCDS), and uses the obesity status of parents as an instrument. Lindeboom et al. (2010) find a significant negative association between obesity and labour market outcomes, but after instrumenting with parental obesity the results are no longer statistically significant. However, the authors are doubtful about the instruments, which did not pass the tests for overidentifying restrictions in several specifications.

Using data from a Danish panel survey from 1995 and 2000, Greeve (2008) analyzes the relationship between body weight, employment status, and wages using the IV models, and whether the respondent's father or mother had been prescribed medication for obesity related health problems. Results show a negative effect of BMI on employment. Sousa (2005) and Atella et al. (2008) investigate the relationship between obesity and wages for European countries using data from the European Community Household Panel. Sousa (2005) finds a negative BMI effect on labour market outcomes for women, and positive BMI effect on labour market outcomes for men.

In addition to studies focused on the developed countries in North America and Europe, Cawley et al. (2009) analyze the association between weight and labour market outcomes among legal immigrants to the US from developing countries. The authors do not find a significant association between weight and employment, wages, or work limitations for men or women; being overweight or obese is associated with lower employment among women who have been in the US for less than 5 years. But there are several limitations of their study as discussed by the authors, such as not accounting for possible endogeneity in obesity, the lack of instruments, the self-reporting height and weight that may lead to measurement error, etc.

Schultz (2008) uses round 13 of the RLMS data conducted in 2004 to investigate the health and disability impacts on labour productivity measured by variations in labour force participation, hours worked, and wage rates. The focus of his study is the impact of health related inputs, which include a medical check-up in the last three months, the consumption of ethanol-equivalent alcohol per day, and the number of cigarettes smoked per day on labour productivity. To correct for potential endogeneity of these health inputs, the author estimates the relationship with labour productivity employing two-stage least squares. Schultz also fits a quadratic function to BMI that reveals an inverted U-shaped pattern on labour force participation and wages, but he does not account for potential endogeneity in BMI.

To sum up, the findings on the body weight impact on labour market outcomes are quite mixed and vary by gender and country. It seems that the impact of the commonly used measure, BMI is stronger for women than for men. Furthermore, the effect on women's employment and wages is usually negative, while for men it is sometimes found to be positive or insignificant. Following the best practice in the existing literature the contribution of this study is to provide robust evidence on the relationship between weight and labour market outcomes measured as employment, wages, and sick-leave days in a transition economy context by using panel data from the Russian Longitudinal Monitoring Survey (RLMS). To allow for potential endogeneity of weight/BMI we experiment with both lagged values of BMI and instrumental variables. To the best of our knowledge our study provides the first empirical evidence from Russia using panel data.

3 Russian labour markets in transition

As a result of the political, economic and social reforms in Russia since the collapse of the centrally planned economy in 1991, the labour market has experienced significant changes. These include emerging unemployment, exploding inflation, sharp declines in production, as well as a decrease in household income during the early years of transition to a market economy. Social indicators point to a fall in living standards, deteriorating health conditions, and increased mortality (Brainer and Cutler, 2005). During the transition years, a central issue has been the reallocation of labour from the former state sector to the newly emerging private sector where the resources are more efficiently utilised. The labour markets reallocated the workers from less to more productive activities, the firms changed their employment practices to respond to market forces, and the relative wages changed to encourage worker reallocation. As a result of structural changes and the imposition of hard budget constraints, unemployment in Russia has increased.[1] This includes decreased state employment due to the closure of state enterprises, limited private employment due to the slow expansion of private sector, and job quitters' entry into unemployment.

Several papers, overviewed in Earle and Lehmann (2002), have studied the labour markets in transition using micro data from Russia. Results show that Russian firms in transition were responding to wage changes by adjusting employment (Konings and Lehmann, 2002), average wages in privatized firms were higher than those in state enterprises (Brainer, 2002), and individual workers were responding to earnings incentives (Sabirianova, 2002). Sabirianova (1998) analyzes the dynamic changes in the Russian labour market based on movements of the population between employment, economic inactivity, and unemployment, and the gender differences in labour mobility. Female labour was less mobile and there was some evidence of non-random selection into employment.

Unemployment has increased steadily since the start of the transition, reaching its peak of 12.9% in 1999 after the Russian financial crisis in 1998, and after that gradually decreasing to 8.2% in 2004 (IMF, 2005). Regional variation in unemployment rates is extremely high in Russia, e.g., in 1999 the unemployment rate in Moscow was 6%, while in the North Caucasus the average rates were over 25%. The collapse of the real wages was drastic also during the period between1994 to 1999. The real wage in Russia started to increase since 2000 (IMF, 2005).

[1] In a number of studies the elimination of labour hoarding is identified as an important (necessary) component of enterprise-restructuring policies, promoted by international financial institutions. Another important (sufficient) component is new investment in productive assets rather than using funds just for survival. The success of restructuring policies is conditional on eliminating the soft budget constraints in the economy (e.g., Rizov, 2005), directly linked to abandoning the state's role in providing full employment.

The combination of macro- and microeconomic changes brought uncertainty in the lives of the Russian citizens, contrary to what was under the previous economic system. Using data from the RLMS, Linz and Semykina (2008) analyze the perceptions of economic insecurity among Russian workers during transition, and find that perceptions of job security were higher among workers with more education, workers who live in places that are not adversely affected by the economic changes, and among workers who have supervisory responsibilities. Their results show that perceptions differ between genders, and that age is negatively correlated with the confidence of keeping a job.

In brief, as established in the labour economics literature, individual characteristics such as gender, age, and education, and macroeconomic environmental factors such as regional unemployment rate and other regional labour market specificities all have an impact on the individual labour market status and performance in Russia. During transition, economic uncertainty increased and job security disappeared, leading to higher competition in the labour market. By 2004 with the commencement of President Putin's second presidential mandate the transition process from plan to market in Russia was effectively completed even though many of the pre-reform institutional legacies remained.

4 Conceptual issues and methodology

Obesity affects employment and wages in two main ways. First, since obesity is the cause of both chronic and acute diseases, obese individuals are more likely to have health problems. Therefore, individuals who are overweight or obese may be less likely in employment and if they were employed earn lower wages compared to their normal weight counterparts, because health problems may decrease their productivity (Baum and Ford, 2004); this is the *supply effect*.

Second, there may be employer discrimination against obese people, which means that they may be less likely to be hired or promoted (Puhl and Brownell, 2001), and therefore, they may work less and earn lower wages; this is the *demand effect*. The goal of this paper is to investigate the effects during the transition in Russia and compare them to the results from previous studies on developed economies.

Following the labour economics literature, in order to determine the effects of obesity (*BMI*) on employment (*EPL*), wage rate (ln*w*), and the number of sick-leave days (*SLD*), and to formalize the causal relationships discussed, we formulate the following three equation econometric model:

$$EPL_{it}^{*} = \beta_0 + \beta_1 X_{ite} + \beta_2 BMI_{it-1} + \beta_3 BMIsq_{it-1} + \delta_i + \eta_{it}\,, \quad \text{i=1,…,N and t=1,…,T} \qquad (1)$$

where EPL_{it}^{*} is unobservable but $EPL_{it} = 1$ if $EPL_{it}^{*} > 0$ and zero otherwise, and the subscripts i and t index individuals and time respectively.

$$\ln w_{it} = \alpha_0 + \alpha_1 X_{itw} + \alpha_2 BMI_{it-1} + \alpha_3 BMIsq_{it-1} + \tau_i + \varepsilon_{it}\,. \qquad (2)$$

$$SLD_{it}^{*} = \chi_0 + \chi_1 X_{its} + \chi_2 BMI_{it-1} + \chi_3 BMIsq_{it-1} + \upsilon_i + \mu_{it}\,, \qquad (3)$$

where SLD_{it}^{*} is partly unobservable as $SLD_{it} = SLD_{it}^{*}$ if $SLD_{it}^{*} > 0$ and zero otherwise. The error terms in equations (1)-(3) include the individual random effects δ_i, τ_i, and υ_i which do not vary with time, and zero-expected-mean error terms η_{it}, ε_{it}, and μ_{it}. It is commonly assumed that δ_i, τ_i, υ_i, and η_{it}, ε_{it}, μ_{it} are normally distributed, mutually independent, and not correlated with the set of explanatory variables ***X*** given the randomness of the sample.

EPL is a binary variable, equal to 1 if the individual is employed and 0 otherwise, while *SLD* and ln*w* are continuous variables but *SLD* is censored, containing 0-value for individuals not reporting any sick-leave days, and positive values for employed individuals reporting sick-leave days due to illness in the last 30 days. ***X*** is a set of exogenous explanatory variables that are shown to be correlated with labour market outcomes in the labour economics literature including age, age squared, household size, education, marital status, number of children in the household, non-labour income control for constraints and incentives of an individual to undertake market employment, occupation, employer characteristics, regional unemployment rate, regional dummies. *BMI* is the key regressor we are interested in, and it is defined as individual weight in kilograms divided by height in meters squared (kg/m^2).[2]

The probability of being employed (eq.1) and the number of days missing work due to illness (eq. 3) are estimated by the random effects Probit and Tobit models respectively. The wage equation (eq. 2) is estimated using a random effects GLS estimator, corrected for selection into employment. The Hausman tests for independence between the respective error terms and explanatory variables do not reject the null hypothesis of independence at conventional levels of the critical values, and suggest that the composite errors are not correlated with the explanatory variables, i.e., random effects models are not biased.[3] Furthermore, our sample is randomly drawn from a large population and our aim is to make inference about the population. Therefore, random effects models are more appropriate here than fixed effects models (Hsiao, 1986; Baltagi, 2001). We also estimate all models by gender because there are significant differences between men and women in the labour market (e.g., Cawley, 2000a; 2004).

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[2] Generally, BMI is used in the literature to measure overweight and obesity (e.g., Baum and Ford 2004; Cawley, 2004; Conley and Glauber, 2007). Although, BMI does not directly measure the percentage of body fat, it provides a more accurate measure of obesity than relying on weight alone. However, BMI has a limitation as a measure of obesity because BMI may overestimate body weight for athletes who have a muscular build, and may underestimate body weight for elderly people who have lost muscle mass (NIDDKD, 1996). However, several studies comparing BMI with a combination of height and weight in adult samples in Russia find that the inferences from these obesity measures are quite similar (e.g., Huffman and Rizov, 2010). In our empirical analysis we also experimented with weight and height as a robustness check; the results are very similar to the ones reported. The reason we use BMI, weight and height is that our dataset contains information only for these anthropometric measurements. We acknowledge that other studies (e.g., Johansson et al. 2009) use, in addition, as obesity measures fat mass and waist circumference.

[3] Nonetheless, in order to ensure the robustness of the results, we estimated fixed effects models as well. The results from these models do not differ qualitatively from the results reported. We also compared pooled (Probit, OLS, and Tobit) models with the random effects models and the Hausman tests rejected the former in favour of the later set of models.

Even though the specification (Hausman) tests did not reject the random effects models suggesting that overall the explanatory variables are exogenous, the standard estimates could still be biased if BMI and the error terms are correlated as reviewed in detail in Cawley (2004). Obesity and employment, wages and sick-leave days might be correlated because: a) unobservable individual effects such as genetic and non-genetic factors included in the error terms may be correlated both with the labour market outcome and with the individual BMI; and b) potential reverse causality may exist between BMI and labour market outcomes. For example, obesity (BMI) may cause unemployment because of supply and/or demand effects (Everett, 1990; Pagan and Davila, 1997). On the other hand, unemployment may cause obesity because unemployed individuals who have lower incomes are more likely to consume cheep, fat-containing food (Cawley, 2004), and exercise less. Therefore, the standard estimates may still be biased due to such a reverse causality.

Previous studies (Averett and Korenman, 1996; Berhman and Rosenzweig, 2001; Cawley, 2004; Brunello and D'Hombres, 2007; Morris, 2007; Greve, 2009) have dealt with the endogeneity and reverse causality issues by either replacing BMI with lags of BMI or using IV methods where as instruments are used variables that are correlated with BMI but uncorrelated with labour market outcomes. However, obtaining unbiased estimates with the IV method depends essentially on the predictive power and validity of instruments. If there is a weak correlation between instruments and BMI, or the instruments are correlated with labour market outcomes, then the IV estimates could still be biased. In our study, first, as an instrument of BMI we use one-period lagged BMI and exogenous individual and regional characteristics. Second, we follow Morris (2007) and create regional (at primary sampling unit (PSU) level) variables that we use as instruments. These are the PSU median BMI generated by five-year age cohorts for the adult population aged 18-60 (PBMI), and the PSU incidence (ratio) of cardiovascular diseases and diabetes in the PSU adult population, reporting some chronic medical condition (PCVD).

5 Data and regression results

Data from the RLMS for the 1994-2005 period is used to investigate the impacts of body weight on labour market outcomes. The RLMS is a nationally representative household survey that annually samples the population of dwelling units. Data include a wide range of information concerning household characteristics such as demographic composition, income, and expenditure. Data on individuals include employment details, anthropometric measures, nutrition, alcohol consumption, and medical condition. The BMI index for each respondent is constructed from data on weight and height collected by trained personnel, and thus it is clear from self-reporting error. Our sample includes all adult individuals of working age 18-60 and consists of 36,917 (21,236 women and 15,681 men) observations. The wealth of relevant variables makes the RLMS particularly appropriate for the purposes of our study. Table 1 presents definitions and summary statistics for the main regression variables.

- Table 1 -

Next we briefly describe trends in BMI and its relationships with labour market outcomes. In the beginning of the period, in 1994, the average BMI for the full sample was 26.1 (kg/m^2), with women having higher average BMI of 26.7. By the end of the period, in 2005, the average BMI has slightly declined to 25.9, with a small increase in men's BMI from 25.0 to 25.2, which still remains lower than women's BMI of 26.5. Throughout the 1994-2005 period both women and men had average BMI that would classify them as overweight; according to WHO (2010) an individual with BMI over 25 is defined as overweight, and with BMI over 30 as obese. Looking at the pattern of obesity, the share of obese people has increased from 20% in 1994 to 28% in 2005. It is important to point out that there was a more significant increase in the share of obese men from 10% in 1994 to 17% in 2005.

Real hourly wage generally increases over the period but there is no clear pattern for wages of obese compared to non-obese individuals. Men earn more than women with an increasing differential since 2001. On average, obese women and men seem to work more hours per month than their non-obese counterparts but the differences are not statistically significant at conventional levels. In terms of the number of work days missed due to illness there is no clear pattern with half of the period, obese men and women having more sick-leave days then their non-obese counterparts. The simple descriptive statistics suggest that there is no noticeable labour market penalty for obese individuals. Such a finding is in line with the evidence from several studies on developed market economies.

Next, to investigate the causal effects of obesity on labour market outcomes, we estimate econometric models controlling for various factors that might bias estimates. Following the relevant literature, we report results where individual BMI is instrumented (IBMI) with regional variables by PSU and age cohort (PBMI and PCVD) as discussed in section 4.[4] Results where BMI is instrumented with one-period lagged BMI are quite similar to the results reported. In addition, we also estimated the models directly using either BMI or one-period lagged BMI. These results are not qualitatively different from the results reported. The likely reason is that

[4] In the first stage of our IV approach we use a parsimonious specification, including the two identification instrumental variables (PBMI and PCVD), gender, age, regional effects and a time trend and estimate the predicted value of BMI (IBMI) by OLS with individual clustering; the first-stage results are reported for the total sample and by gender in the Appendix, Table A1. The F-statistics for joint significance of the first-stage variables are above the critical values (and larger than 10) for all samples; the same applies to the F-statistics for joint significance of PBMI and PCVD only. As a further test, we introduce PBMI and PCVD in the second-stage equations, excluding BMI. The results show that the identification variables are not statistically significant, individually or jointly, in any second-stage equation, while the coefficients of other variables are not influenced by their inclusion.

obesity (BMI) is related to predetermined dietary and lifestyle patterns that evolve slowly and are strongly serially correlated in a manner similar to a first-order Markov process. We also argue here that the effects of environmental shocks, including shocks from the labour market, affect BMI in a cumulative manner over a relatively long period of time, therefore the contemporaneous shocks are not likely to have any significant reverse causality effect on BMI.

The marginal effects of IBMI on employment, wages, and sick-leave days are presented in Table 2, for the total sample and separately for men and women.[5] These are our results of main interest and we discuss them in some detail below. In the Appendix, Tables A2 to A4 we report the full sets of estimated coefficients.[6]

- Table 2 -

BMI and employment

The relationship between BMI and probability of employment is estimated with panel random effects Probit model using the STATA *xtprobit* procedure. In the total sample the marginal effect of instrumented BMI (IBMI) on employment is negative but not statistically significant. The results for the subsamples by gender indicate that IBMI has a negative effect on employment for women since the marginal effect is negative and significant, while IBMI positively affects employment for men as the marginal effect is positive and significant. There is no evidence of non-linearity of the effects over the relevant range of BMI. Our results are consistent with Morris (2007) and Sousa (2005) and provide clear evidence of opposite effects of BMI on women's and

[5] We also run regressions and estimated marginal effects for subsamples of only overweight and obese individuals (with BMI>25); the marginal effects for these subsamples are not statistically significant and do not differ by gender.

[6] We estimate the specifications presented in Tables A2 to A4 by stepwise introducing the individual traits variables, education, marital status, number of children, and occupation (for the specifications in tables A3 and A4). The coefficients of all variables at each stage of this exercise remained stable and similar to the ones from the full specifications reported in the paper. The results from the stepwise introduction of variables are consistent with our specification test results discussed in p.11.

men's employment opportunities; overweight and obese women may be hampered or discriminated against in accessing employment.

BMI and wages

The relationship between BMI and wages (log of wage rate) is estimated with random effects GLS models for the whole sample and by gender. We have included the inverse Mills' ratio, calculated as the cumulative normal density function divided by the probability density function, in the wage equation to correct for the selection bias due to the choice into employment.[7] The marginal effect of IBMI on wages in the total sample is positive and significant. The effect is also positive and significant in the women's subsample while in the men's subsample it is not statistically different from zero. Our findings with data from a transition economy differ from studies on developed countries by Averett and Korenman (1996), Behrman and Rosenzweig (2001) and Johansson et al. (2009) who do not find wage penalty for obese workers and Baum and Ford (2004) who find that obese workers suffer a wage penalty.

BMI and sick-leave days

The relationship between BMI and the number of sick-leave days is estimated with a random effects Tobit models for the whole sample, and by gender using the STATA *xttobit* procedure. It is assumed that the incidence of sick-leave days and their number are determined by similar factors.[8] The effect of IBMI on the number of work days missed due to health problems is linear and positive in the relevant range of BMI for the total, and for the men's samples, but it is not statistically significant. The effect of IBMI on women's sick-leave days is also positive but

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[7] The inverse Mill's ratio is calculated on the basis of the employment equation (eq.1). The identification variables are marital status, household composition and non-earned income, and they satisfy the Wald and RESET-type validity tests.

[8] We performed likelihood ratio tests of the differences between Tobit and two-stage models for the total sample and by gender; the χ^2-statistics are below the critical values indicating that the decision to take a sick leave and the amount of days spend on leave are determined by the same set of factors.

statistically significant. Our results are in line with the study by Laarsonen et al. (2007) who find that employed overweight women (and men) face a significantly higher risk of sick leave, compared to normal weight and underweight employees. Similarly, Schmier et al. (2006) find that overweight and obese employees have higher absenteeism and more workplace injuries.

The effects of the other (control) variables included in the analysis are consistent with the labour economics literature suggesting that our specifications are correct (see the Appendix). In brief, university education has a positive and statistically significant effect on employment and wages. Age has a nonlinear concave effect on probability of employment and a U-shaped effect on the number of work days missed due to sickness. Marriage increases the men's probability of working but decreases the women's. Women with younger children have lower probability of working. Employees with a managerial or professional occupation have higher wages. The wages of employees in foreign and private companies are higher compared to the wages of state employees. There are also significant regional differences in employment; employment is less likely where the regional unemployment rate is higher and in rural areas. Regional unemployment is associated also with significantly lower wage rates, especially for women. Wages in all regions in Russia compared to the metropolitan Moscow and St. Petersburg regions are lower both for men and women and wages in rural areas are lower compared to urban areas irrespective of gender. In all specifications, time trend is included and it is found to be statistically significant.

6 Conclusion

The paper focuses on the impacts of body weight on the probability of employment, wages, and the incidence of sick-leave days in Russia. Analysing the relationships between body weight, in general and overweight and obesity in particular, and labour market outcomes is important for understanding the functioning of the labour market and the role that individual physical characteristics may play in affecting an individual's access to employment and income generating opportunities. While there is growing number of relevant studies, the issue has not been analysed in a transition economy context, with complex institutional setting, and there lies our contribution to the literature.

Using BMI as a measure of body weight, we find a negative effect on probability of employment for women and positive effect for men in Russia. Interestingly, not only we did not find evidence of wage penalty for higher BMI, but we even found that the effect of BMI on wages is positive for women in Russia. This result differs from findings of several studies on developed market economies. There is also positive impact of BMI on the number of work days missed due to health problems for women which is consistent with previous studies. Overall, it seems that during the transition in Russia, the increased competitive pressure in the labour market combined with economic insecurity faced by the population and complex institutional legacies lead to muted impact of an individual's body weight on labour market outcomes; the majority of the relevant marginal effects are only significant at the ten percent level. Furthermore, the results from the three models taken together seem to suggest that the effects of body weight are related more to supply side factors such as incentives and ability to work rather than to discrimination from the demand side of the labour market.

However, considering that overweight and obesity (BMI of 25 or more) is likely to negatively affect future productivity in the society beyond the transition period, healthy weight maintenance is a crucial issue in promoting occupational functionality and minimizing the costs associated with sickness absence. This is likely to have an important impact on the national welfare systems which are notoriously poor in transition economies. Given that the policy implications suggested by the findings of our study are gender, age, and location specific, more effective policies for improving the labour market performance of Russian population should be formulated by targeting specific labour force segments for achieving optimal weight.

A possible limitation of our study is that we use BMI as a measure of obesity. There are several other measures along with BMI such as fat mass and waist circumference that are likely more adequate than BMI, which does not distinguish between fat and fat-free mass (muscle and bone). This could possibly have some implication for the interpretation of our results. Future research may strive to use an alternative measure, data permitting, to better capturing the effect of physical appearance and ability on individuals' labour market performance. Furthermore, exploring individual labour market histories with more detailed survey (or case study) data would help better understand our finding that women's wage increases with BMI in Russia. Finally, replicating our study with data from other transition economies will help better understand and qualify our findings.

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Table 1 Definitions of regression variables and summary statistics

Variable	Mean (SD)	Definition
Dependent Variables		
Employment (EMP)	0.82 (0.39)	Dummy variable equal to 1 if the individual is in the labour force and 0 otherwise
Wage (*w*)	13.74 (44.57)	Individual real hourly wage rate in Rubles (base 2000)
Sick-leave days (SLD)	0.06 (0.24)	Number of days the individual missed work due to illness in the last 30 days
Explanatory Variables		
BMI	25.85 (4.92)	Individual weight divided by height squared (kg/m2)
Age	37.98 (11.58)	Age in years (working age individuals)
Male	0.42 (0.49)	Dummy variable equal to 1 if the individual is a male and 0 otherwise
Base education	0.24 (0.43)	Dummy variable equal to 1 if the individual has base education or education of up to 8 years and 0 otherwise
High education	0.60 (0.49)	Dummy variable equal to 1 if the individual has completed high school and 0 otherwise
University education	0.17 (0.38)	Dummy variable equal to 1 if the individual has completed university education and 0 otherwise
Married	0.72 (0.45)	Dummy variable equal to 1 if the individual is married and 0 otherwise
Household size	3.60 (1.51)	Adult equivalent number of household members
Children 6	0.08 (0.13)	Share of children of age 6 years or below in the household
Children16	0.15 (0.19)	Share of children of age above 6 years in the household
Non-labour income	237.48 (2294.38)	Real monthly non-labour income in Rubles (base 2000)
Unemployment rate	0.09 (0.05)	Regional unemployment rate
Manager	0.15 (0.35)	Dummy variable equal to 1 if the individual is in managerial or professional job and 0 otherwise
Foreign firm	0.04 (0.19)	Dummy variable equal to 1 if the firm of employment is foreign owned and 0 domestically owned
Private firm	0.38 (0.48)	Dummy variable equal to 1 if the firm of employment is private owned and 0 if state owned.
Rural	0.31 (0.46)	Dummy variable equal to 1 if the individual resides in rural area and 0 otherwise
PBMI	25.33 (2.82)	Median BMI generated by five-year age cohorts at PSU level
PCVD	0.15 (0.06)	Incidence (ratio) of cardiovascular diseases and diabetes in the chronic medical conditions reported at PSU level

Notes: Total number of observations is 36917. In every regression we use a set of seven regional dummy variables (North and Northwest, Central, Volga, North Caucasus, Ural, West Siberia, East Siberia), with a reference category Moscow-St Petersburg metropolitan regions.

Table 2 Marginal effects of IBMI on labour market outcomes

Dependent variable	Marginal effect (SE)		
	All	**Women**	**Men**
EPL	-0.016 (0.011)	-0.034 (0.017) **	0.024 (0.014) *
ln*w*	0.010 (0.006) *	0.012 (0.007) *	0.006 (0.008)
SLD	0.018 (0.014)	0.017 (0.009) *	0.018 (0.021)

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix

Table A1 First-stage OLS estimates of the determinants of BMI equation

Variable	**Dependent variable: BMI; Coefficient (SE)**		
	All	**Women**	**Men**
PBMI	0.771 (0.105) ***	0.818 (0.135) ***	0.643 (0.162) ***
PCVD	0.190 (0.033) ***	0.052 (0.019) ***	0.505 (0.084) ***
Gender	-1.180 (0.043) ***	-	-
Age	0.177 (0.013) ***	0.237 (0.017) ***	0.153 (0.018) ***
Age_sq*10^2	-0.181 (0.016) ***	-0.220 (0.022) ***	-0.199 (0.022) ***
North and Northwest	-0.139 (0.129)	-0.065 (0.176)	-0.271 (0.181)
Central	0.048 (0.105)	0.170 (0.144)	-0.176 (0.145)
Volga	0.076 (0.104)	0.178 (0.143)	-0.294 (0.143) **
North Caucasus	0.184 (0.103) *	0.070 (0.157)	0.257 (0.142) *
Ural	-0.121 (0.106)	0.058 (0.145)	-0.369 (0.145) ***
West Siberia	0.027 (0.125)	0.381 (0.175) **	-0.489 (0.167) ***
East Siberia	-0.033 (0.117)	0.150 (0.162)	-0.262 (0.152) *
Rural	0.026 (0.048)	0.157 (0.070) **	-0.107 (0.062) *
Time trend	0.023 (0.008)***	0.022 (0.011) **	0.032 (0.010) ***
R^2	0.384	0.417	0.397
F-statistics	1171 ***	996 ***	369 ***
Number of observations	36917	21236	15681

Notes: Robust standard errors are reported in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A2 Random effects Probit estimates of the probability of employment equation

Variable	**Dependent variable: EMP; Coefficient (SE)**		
	All	**Women**	**Men**
IBMI	-0.079 (0.071)	-0.142 (0.085) *	0.012 (0.141)
IBMI_sq*10^2	0.109 (0.108)	0.231 (0.151)	-0.014 (0.264)
Gender	0.633 (0.046) ***	-	-
Age	0.425 (0.012) ***	0.482 (0.015) ***	0.302 (0.018) ***
Age_sq*10^2	-0.568 (0.014) ***	-0.648 (0.018) ***	-0.415 (0.022) ***
University education	0.810 (0.064) ***	0.984 (0.083) ***	0.499 (0.099) ***
High education	0.097 (0.040) **	0.140 (0.053) ***	0.022 (0.061)
Married	0.151 (0.040) ***	-0.167 (0.049) ***	0.837 (0.075) ***
ln(Household size)	-0.371 (0.057) ***	-0.355 (0.072) ***	-0.308 (0.094) ***
Children 6	-0.038 (0.128)	-0.493 (0.155) ***	0.294 (0.239)
Children16	0.067 (0.100)	0.151 (0.128)	-0.065 (0.165)
ln(Non-labour income)	-0.059 (0.005) ***	-0.054 (0.006) ***	-0.072 (0.008) ***
Unemployment rate	-4.370 (0.403) ***	-3.640 (0.522) ***	-5.418 (0.624) ***
North and Northwest	0.572 (0.130) ***	0.491 (0.167) ***	0.666 (0.198) ***
Central	0.104 (0.098)	0.053 (0.125)	0.192 (0.148)
Volga	0.027 (0.097)	0.028 (0.124)	0.027 (0.147)
North Caucasus	-0.080 (0.108)	-0.139 (0.139)	0.075 (0.164)
Ural	0.316 (0.101) ***	0.228 (0.129) *	0.407 (0.154) ***
West Siberia	0.077 (0.117)	-0.044 (0.151)	0.232 (0.176)
East Siberia	0.466 (0.115) ***	0.220 (0.147)	0.823 (0.176) ***
Rural	-0.430 (0.050) ***	-0.407 (0.066) ***	-0.416 (0.072) ***
Time trend	-0.036 (0.004)***	-0.032 (0.006) ***	-0.043 (0.007) ***
Log likelihood	-11911	-7500	-4287
Number of observations	36917	21236	15681

Notes: Robust standard errors are reported in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A3 Random effect GLS estimates of the wage equation

Variable	**Dependent variable: ln*w*; Coefficient (SE)**		
	All	**Women**	**Men**
IBMI	0.042 (0.046)	0.060 (0.054)	0.066 (0.095)
IBMI_sq*10^2	-0.063 (0.083)	-0.092 (0.096)	-0.115 (0.177)
Gender	0.266 (0.023) ***	-	-
Age	0.026 (0.007) ***	0.031 (0.009) ***	0.017 (0.010) *
Age_sq*10^2	-0.036 (0.008) ***	-0.039 (0.010) ***	-0.026 (0.013) **
University education	0.226 (0.034) ***	0.237 (0.044) ***	0.232 (0.052) ***
High education	0.027 (0.023)	0.032 (0.030)	0.003 (0.034)
Manager	0.105 (0.025) ***	0.170 (0.030) ***	0.002 (0.047)
Foreign firm	0.329 (0.042) ***	0.336 (0.065) ***	0.315 (0.055) ***
Private firm	0.114 (0.018) ***	0.135 (0.024) ***	0.090 (0.027) ***
Unemployment rate	-1.350 (0.367) ***	-2.248 (0.447) ***	-0.399 (0.630)
North and Northwest	0.044 (0.066)	-0.014 (0.083)	0.129 (0.107
Central	-0.370 (0.044) ***	-0.376 (0.056) ***	-0.369 (0.070) ***
Volga	-0.475 (0.044) ***	-0.468 (0.055) ***	-0.487 (0.071) ***
North Caucasus	-0.315 (0.053) ***	-0.301 (0.066) ***	-0.327 (0.087) ***
Ural	-0.312 (0.047) ***	-0.304 (0.060) ***	-0.315 (0.077) ***
West Siberia	-0.341 (0.059) ***	-0.336 (0.077) ***	-0.372 (0.092) ***
East Siberia	-0.174 (0.058) ***	-0.172 (0.074) ***	-0.175 (0.091) **
Rural	-0.275 (0.036) ***	-0.257 (0.046) ***	-0.312 (0.059) ***
Time trend	0.033 (0.005) ***	0.043 (0.007) ***	0.025 (0.010) ***
Mills ratio	-1.586 (0.527) ***	-1.019 (0.164) ***	-2.074 (0.210)***
Wald chi2	4236 (21)	1940 (20)	2457 (20)
Number of observations	19777	11046	8731

Notes: Robust standard errors are reported in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A4 Random effects Tobit estimates of the sick-leave days equation

Variable	Dependent variable: SLD; Coefficient (SE)		
	All	**Women**	**Men**
IBMI	2.155 (1.529)	1.704 (0.866) **	2.919 (3.245)
IBMI_sq*10^2	-2.134 (2.778)	-1.965 (1.031) *	-3.084 (3.075)
Gender	-0.093 (0.062)	-	-
Age	-0.235 (0.233)	0.190 (0.314)	-0.777 (0.356) **
Age_sq*10^2	0.310 (0.292)	-0.233 (0.398)	1.007 (0.441) **
University education	-1.307 (0.978)	-1.313 (1.302)	-1.062 (1.500)
High education	-0.816 (0.717)	-0.456 (1.006)	-1.093 (1.025)
Manager	0.762 (0.805)	1.972 (0.980) **	-2.191 (1.262) *
Foreign firm	0.376 (1.484)	2.681 (2.171)	-1.785 (2.041)
Private firm	-0.467 (0.607)	-1.398 (0.839) *	0.524 (0.892)
Married	0.825 (0.731)	0.477 (0.890)	1.298 (1.416)
ln(Household size)	-5.075 (1.142)***	-5.724 (1.503) ***	-4.453 (1.801) ***
Children 6	1.866 (2.390)	2.458 (3.167)	1.490 (3.870)
Children16	1.587 (1.839)	1.462 (2.338)	1.793 (3.096)
ln(Non-labour income)	0.187 (0.110) *	0.225 (0.134) *	0.080 (0.195)
Unemployment rate	-12.568 (4.948) ***	-11.505 (6.108)*	-13.856 (7.034) **
North and Northwest	2.800 (1.703)	1.435 (2.226)	4.354 (2.661) *
Central	0.846 (1.325)	-0.050 (1.709)	1.836 (2.107)
Volga	0.026 (1.368)	-0.957 (1.763)	1.247 (2.178)
North Caucasus	0.780 (1.636)	-1.634 (2.154)	3.573 (2.537)
Ural	0.258 (1.409)	-0.844 (1.824)	1.524 (2.230)
West Siberia	1.071 (1.686)	-0.623 (2.214)	3.193 (2.616)
East Siberia	1.841 (1.605)	1.076 (2.119)	2.873 (2.478)
Rural	-0.986 ((0.741)	0.595 (1.004)	-2.867 (1.104) ***
Time trend	-0.586 (0.097) ***	-0.647 (0.126)***	-0.505 (0.152) ***
Log likelihood	-12508	-7207	-5286
Number of observations	19777	11046	8731

Notes: Robust standard errors are reported in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.